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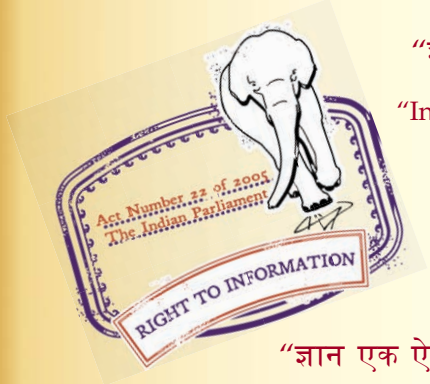
IS 9175-16 (1987): Rationalized Steels for Automobile and Ancillary Industry, Mechanical and Physical Properties - Part 16 35Mn6Mo3 Grade steel [MTD 16: Alloy Steels and Forgings]



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"Knowledge is such a treasure which cannot be stolen"

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IS : 9175 (Part 16) - 1987
(Reaffirmed 2004)

Indian Standard

SPECIFICATION FOR RATIONALIZED STEELS FOR THE AUTOMOBILE AND ANCILLARY INDUSTRY

PART 16 MECHANICAL AND PHYSICAL PROPERTIES OF 35Mn6Mo3 GRADE STEEL

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PART 16 MECHANICAL AND PHYSICAL PROPERTIES OF 35Mn6Mo3 GRADE STEEL

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(*Continued on page* 11)

Indian Standard

SPECIFICATION FOR RATIONALIZED STEELS FOR THE AUTOMOBILE AND ANCILLARY INDUSTRY

PART 16 MECHANICAL AND PHYSICAL PROPERTIES OF 35Mn6Mo3 GRADE STEEL

0. FOREWORD

0.1 This Indian Standard (Part 16) was adopted by the Indian Standards Institution on 15 January 1987, after the draft finalized by the Co-ordinating Committee on Materials for Automobiles had been approved by the Structural and Metals Division Council.

0.2 Part 1 of this standard was published in 1979 which covers the chemical composition of 33 rationalized steels. The mechanical properties, hardenability and isothermal transformation characteristics of these 33 rationalized steels are being covered in different parts of this standard (Parts 2 to 34). The data concerning these properties, given in this standard, is only for guidance and information purposes.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

---

1. SCOPE

1.1 This standard (Part 16) covers the chemical composition, mechanical properties, hardenability and isothermal transformation characteristics of 35Mn6Mo3 grade of steel for use by automobile and ancillary industry.

*Rules for rounding off numerical values (*revised*).

1.2 This is a low alloy steel intended to be used in the hardened and tempered condition.

2. CHEMICAL COMPOSITION

2.1 The chemical composition of this grade of steel shall be as given below:

Constituents, Percent

C	Si	Mn	Mo	S	P
0·30-0·40	0·15-0·35	1·30-1·80	0·20-0·35	0·035	0·035

3. HARDNESS

3.1 The maximum hardness for this grade of steel delivered in the annealed condition, when determined in accordance with IS : 1500-1983*, shall be 220 HB.

3.2 The surface hardness obtainable of this grade of steel by flame or induction hardening shall be 53-59 HRC.

4. MECHANICAL PROPERTIES

4.1 The mechanical properties of this grade of steel in the hardened and tempered condition when determined in accordance with IS : 1598-1977† and IS : 1608-1972‡ shall be as given in Table 1.

TABLE 1 MECHANICAL PROPERTIES IN HARDENED AND TEMPERED CONDITION

Limited Ruling Section	Tensile Strength	0·2 Percent Proof Stress, *Min*	Elongation on Gl $5{\cdot}65\sqrt{So}$, *Min*, Percent	Izod Impact, *Min*	Hardness
(1)	(2)	(3)	(4)	(5)	(6)
	MPa	MPa		Joules	HB
150	700-850	540	14	55	201-255
100	780-930	600	12	50	223-277
63	850-1 000	700	12	50	248-302
30	950-1 100	800	10	45	331-369

*Method for Brinell hardness test for metallic materials (*second revision*).

†Method for izod impact test of metals (*first revision*).

‡Method for tensile testing of steel products (*first revision*).

5. HOT WORKING AND HEAT TREATMENT TEMPERATURES

5.1 The recommended hot working and heat treatment temperature shall be as given below:

Forging, rolling and stamping temperature	1 250°C
Annealing temperature	830-860°C
Normalizing temperature	830-860°C
Process annealing temperature	640-660°C
Hardening temperature	830-860°C
Tempering temperature	660°C

6. HARDENABILITY

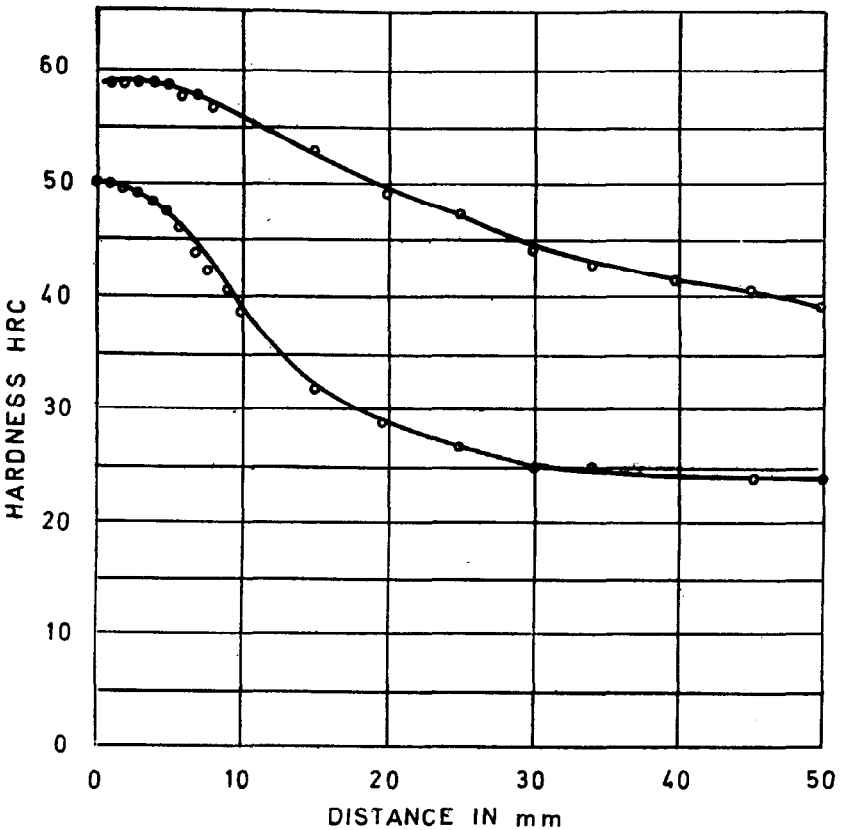
6.1 The end quench hardenability curves band and hardness traverse curves are given in Fig. 1 and 2.

7. EFFECT OF TEMPERING ON MECHANICAL PROPERTIES

7.1 The curves for effect of tempering on the mechanical properties of the steel are given in Fig. 3 and 4.

8. EFFECT OF SECTION SIZE ON MECHANICAL PROPERTIES

8.1 The curves for the effect of section size on mechanical properties are given in Fig. 5.



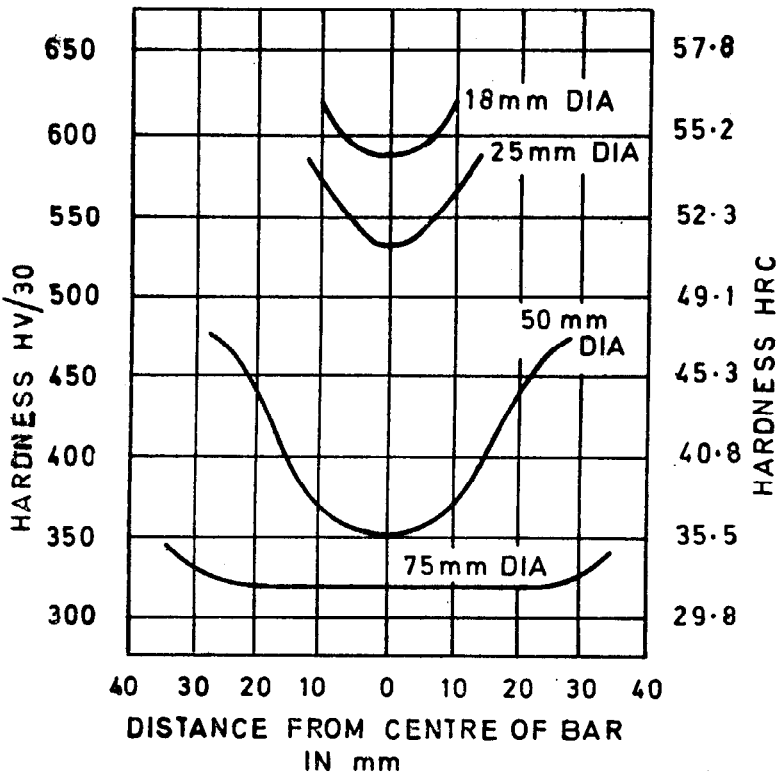
Chemical Composition, Percent

C	Si	Mn	S	P	Ni	Cr	Mo
0·36	0·24	1·47	0·039	0·029	0·11	0·16	0·26

Acid open hearth steel
Grain size 6
End quenched from 850°C
Distance from quenched end of bar in mm

Distance mm	1	2	3	4	5	6	7	8	9	10	15	20	25	30	35	40	45	50
Hardness HRC (Max)	59	59	59	59	59	58	58	57	57	56	53	49	47	44	43	41	41	36
Hardness HRC (Min)	50	49	49	48	48	46	44	42	41	39	32	29	27	25	25	24	24	24

FIG. 1 END QUENCH HARDENABILITY CURVE OF 35Mn6Mo3 GRADE STEEL

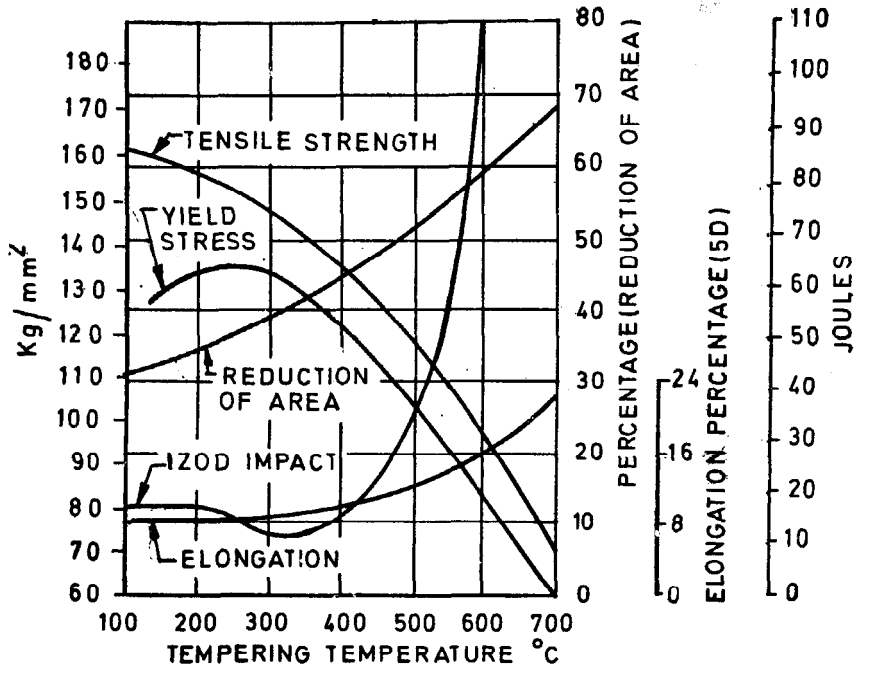


Chemical Composition, Percent

C	Si	Mn	S	P	Ni	Cr	Mo
0·35	0·25	1·43	0·031	0·030	0·23	0·20	0·25

Basic open hearth steel
Grain size 7-8

FIG. 2 HARDNESS TRAVERSE CURVES OF 35Mn6Mo3 GRADE STEEL



Chemical Composition, Percent

C	Si	Mn	S	P	Ni	Cr	Mo
0·35	0·31	1·49	0·012	0·023	0·31	0·21	0·27

Basic open hearth steel
28 mm dia
Bars oil quench 850°C

FIG. 3 CURVES SHOWING THE EFFECT OF TEMPERING TEMPERATURE ON THE MECHANICAL PROPERTIES OF 35Mn6Mo3 GRADE STEEL

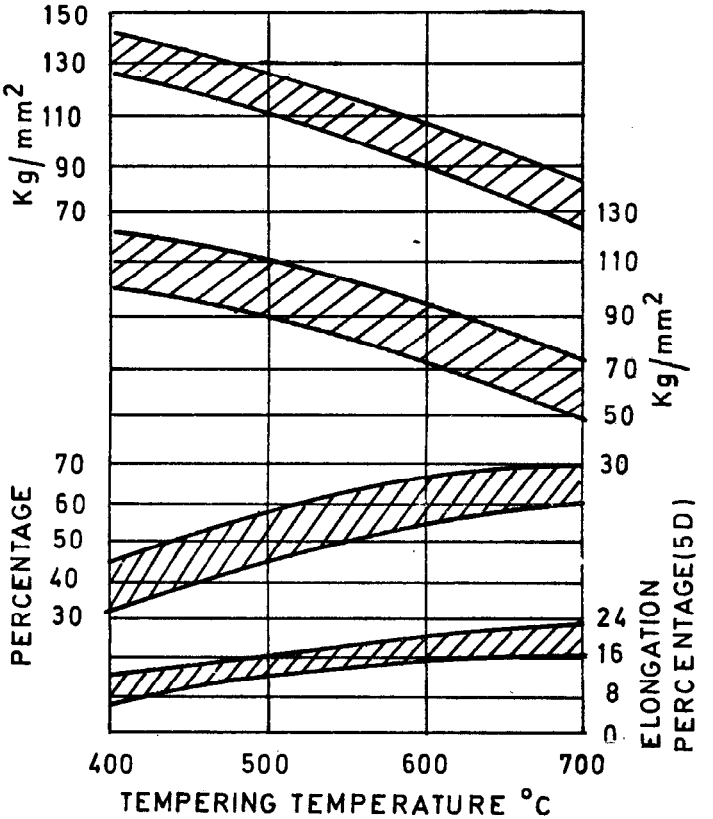
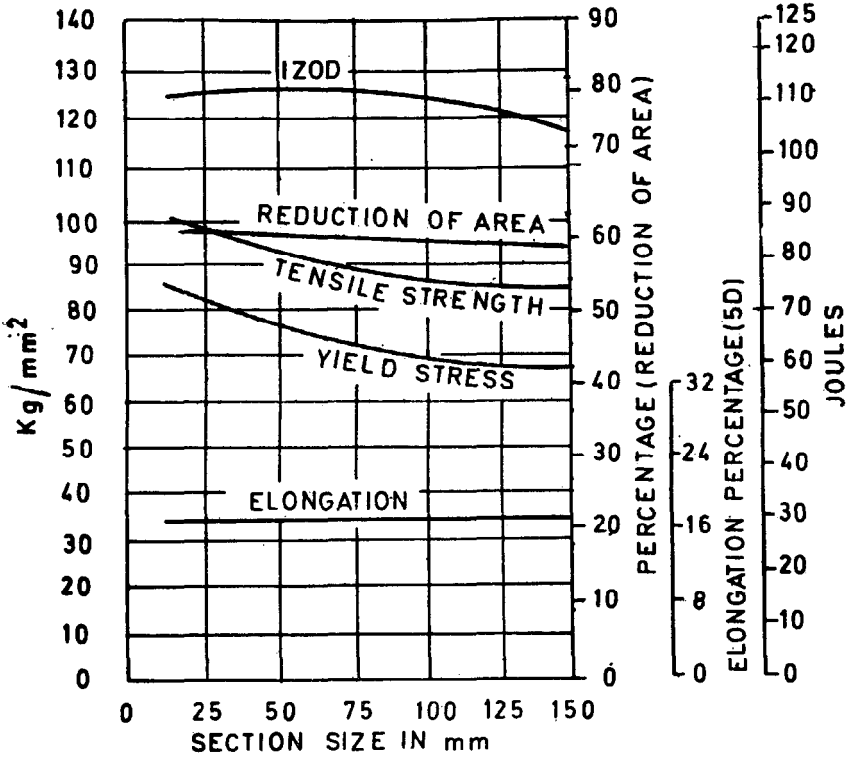


FIG. 4 BANDS SHOWING THE EFFECT OF TEMPERING TEMPERATURE ON THE RANGE OF MECHANICAL PROPERTIES OF 35Mn6Mo3 GRADE STEEL



(Typical Curves)
Bar Oil Quenched 850°C Tempering 600°C

FIG. 5 CURVES SHOWING THE EFFECT OF SECTION SIZE ON MECHANICAL PROPERTIES OF 35Mn6Mo3 GRADE STEEL

(*Continued from page* 2)

Panel to Collect Data on Steel for Automobile Purpose, SMDC 31 : P-12

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg,m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s(s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2